

NON-VOLATILE MEMORY STORAGE INTEGRATED CIRCUIT

BACKGROUND OF THE INVENTION

1. The field of the invention

[0001] The present invention provides a non-volatile memory storage integrate
5 circuit, and particularly a non-volatile memory storage integrate circuit comprising a USB
interface terminal, a controlling IC, a NAND flash memory IC, a memory IC, an I/O
control interface terminal, memory card interface terminal and a memory interface
terminal.

2. Description of the related art

10 [0002] Nowadays the USB interface is the standard interface of the PC/NB/IA
products, and these products are bootable by using the storage media with the USB
interface and the capacity of the hard disk is accordingly increased. However, the
inconvenience is existed for the available storage media with the serial transmission
interface are mostly external peripheral devices.

15 [0003] The available miniaturized IA products, such as PDA, industrial computer,
digital camera and the like, require additional operating systems, for example, Win
CE/Linux, for the multi-functional design. A CPU and a NOR type flash memory are
required for storing the booting program of these operation system. And if any data
storage space is required, then additional SRAM or built-in NAND flash memory are
20 needed for meeting such requirements. However, the above objectives are not in
compliance with the standard Win CE/Linux interface, and therefore, the designers need
to alter the driver program or appliance program for this operation system, and an
additional memory card with retrieving and storing interface IC functionalities is required

for retrieving and storing memory. Therefore, the expense on researching and developing modified or new driver program or appliance program for every new product is very high.

SUMMARY OF THE INVENTION

[0004] Accordingly, in the view of the foregoing, the present inventor makes a detailed study of related art to evaluate and consider, and uses years of accumulated experience in this field, and through several experiments, to create a new a non-volatile memory storage integrate circuit that can be used as basic I/O system (BIOS). Accordingly, modification of the driver program or appliance program for every new product can be effectively avoided.

[0006] According to one aspect of the present invention, a controlling IC (including the solder balls thereof), a NAND IC (including the solder balls thereof) and a memory IC (including the solder balls thereof) are integrated into a single non-volatile memory storage integrated circuit and packaged into a single package, accordingly the connector of the package comprises:

at least a USB transmission interface terminal of the controlling IC for connecting with the electronic device;

at least a I/O control interface terminal of the controlling IC for connecting with the electronic device;

at least a memory card IC interface terminal (such as SD/MMC, SM, MS, CF/ATAPI) of the controlling IC for connecting with memory card (such as CF card and SM card); and

at least a memory interface terminal (SRAM terminal/NOR IC terminal) for connecting with memory externally for increasing the capacity and used as the basic I/O system (BIOS).

[0007] The non-volatile memory storage integrated circuit of the present invention can also be designed to integrate a USB transmission interface connector terminal for building the non-volatile memory storage integrate circuit into a PDA, industrial computer, digital camera and so on. The non-volatile storage integrated circuit can be applied as a bootable silicon chip, storage for the program code and data, and the function thereof will be just like a hard disk of a computer.

10 BRIEF DESCRIPTION OF THE DRAWING

[0008] For a more complete understanding of the present invention, reference will now be made to the following detailed description of preferred embodiments taken in conjunction with the accompanying drawings, in which:

[0009] FIG. 1 is a block diagram of the non-volatile memory storage integrated circuit according to a preferred embodiment of the present invention;

[0010] FIG. 2 is a block diagram of the non-volatile memory storage integrated circuit according to another preferred embodiment of the present invention; and

[0011] FIG. 3 is a block diagram of the non-volatile memory storage integrated circuit according to another preferred embodiment of the present invention.

20 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0012] Reference will be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. Wherever

possible, the same reference numbers are used in the drawings and the description to refer to the same or like parts.

[0013] Referring to FIG. 1, shows a block diagram of the non-volatile memory storage integrated circuit according to preferred embodiment of the present invention.

5 The package of the non-volatile memory storage integrated circuit **10** comprises a USB transmission interface terminal **11**, a controlling IC **12**, a NAND IC **13**, a memory IC **14**, I/O control interface terminal **15**, a memory card interface terminal **16** and a memory interface terminal **17**. Wherein the controlling IC **12** has a built-in ECC and calculation means. The controlling IC **12** is for retrieving and storing data into the flash memory cell.

10 The memory IC **14** comprises a booting program code for installing the non-volatile memory storage integrated circuit **10** in the circuit of an electronic device, for example, a PDA, an industrial computer, a digital camera and the like. While booting the computer, the controller of the electronic device retrieves the booting program code from the memory IC **14** of the non-volatile memory storage integrated circuit **10**. The memory IC

15 **14** can be used as the basic I/O system of the electronic device. An electronic device can connect and communicate with the non-volatile memory storage integrated circuit **10** through the USB transmission interface terminal **11** and the I/O control interface terminal **15** without the need of installing any driver program. Additionally, the capacity of the memory interface terminal **17** of the non-volatile memory storage integrated circuit **10**

20 can be extendable by merely connecting the terminal corresponding to the memory interface terminal **17** to the desired memory terminal. Further, the memory IC **14** can also extend the capacity of the non-volatile memory storage integrated circuit **10**. Besides, the electronic device can also use the memory card interface terminal **16** of the

non-volatile memory storage integrated circuit **10** to connect and communicate with the memory card, such as CF card and SM card).

[0014] FIG. 1 also shows the non-volatile memory storage integrated circuit **10** may be packaged into a Chip Scale Package (CSP) and Ball Grid Array (BGA).

5 [0015] Referring to FIG. 2, the memory IC **14** of the non-volatile memory storage integrated circuit **10** (as shown in FIG. 1) may be a SRAM IC **141**. The NAND IC **13** has a booting program code to for installing the non-volatile memory storage integrated circuit **10** in the circuit of an electronic device, for example, a PDA, an industrial computer, a digital camera and the like. While booting the device, the controller IC **12** of
10 the non-volatile memory storage integrated circuit **10** retrieves the booting program code from the NAND IC **13** then writes it into the SRAM IC **141**. The SRAM IC **141** can be used as the basic I/O system of the electronic device. Further, the NAND IC **13** and the SRAM IC **141** of the non-volatile memory storage integrated circuit **10** are individually connected with the NAND IC terminal **131** and SRAM IC terminal **1411** to easily extend
15 the capacity of the non-volatile memory storage integrated circuit **10**, by merely connecting the terminal corresponding to the SRAM IC terminal **1411** to the desired memory terminal. Furthermore, by using the memory IC the capacity of the non-volatile memory storage integrated circuit **10** can be further extended.

[0016] Referring to FIG. 3, the memory IC **14** of the non-volatile memory storage
20 integrated circuit **10** (as shown in FIG. 1) may be a NOR IC **142**. The NOR IC **142** has a booting program code for installing the non-volatile memory storage integrated circuit **10** in the circuit of an electronic device, for example, a PDA, an industrial computer, a digital camera and the like. While booting the device, the controller of the electronic

device retrieves the booting program code from the NOR IC 142. The NOR IC 142 can be used as the basic I/O system of the electronic device. The NAND IC 13 and the NOR IC 142 of the non-volatile memory storage integrated circuit 10 are individually connecting to the NAND IC terminal 131 and NOR IC terminal 1421 to easily extend the capacity of the non-volatile memory storage integrated circuit 10, merely by connecting the terminal corresponding to the NOR IC terminal 1421 to the desired memory terminal. Further by using the memory IC the capacity of the non-volatile memory storage integrated circuit 10 can be further extended.

[0017] Therefore, the embodiments of the present invention can directly support the storage media with the USB transmission interface without any extra driver program, and the need for researching and developing driver or appliance program can be effectively avoided and thereby the cost on research and development for this purpose can be effectively eliminated. The controller IC 12 supports In-System-Programming, and the program code of the USB controller can be changed directly through the USB transmission interface terminal 11.

[0018] While the invention has been described in conjunction with a specific best mode, it is to be understood that many alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications, and variations in which fall within the spirit and scope of the included claims. All matters set forth herein or shown in the accompanying drawings are to be interpreted in an illustrative and non-limiting sense.